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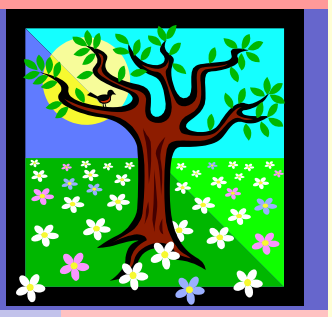

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Syndromic Surveillance

by Loren Shaffer, M.P.H., Bioterrorism Surveillance Supervisor, Bioterrorism

The term "syndromic surveillance" has been used by many over the past few years. Some of those hearing it, although familiar with some of the specific aspects, may not realize fully just what syndromic surveillance is. The Centers for Disease Control and Prevention (CDC) states that syndromic surveillance "applies to surveillance using health-related data that precede diagnosis and signal a sufficient probability of case[s] or an outbreak to warrant further public health response" (1). Although the word "syndromic" is included in the term, much more is considered than syndromes, signs and symptoms that appear within a population.

Data Sources

Any heath-related data preceding clinical diagnosis can be considered for syndromic surveillance. Examples include surveillance of over-the-counter pharmaceuticals, absentee counts from schools or employers, calls made to nurse hotlines as well as hospital emergency department visits. Because the majority of these data come from existing records, little to no additional work is required to gather this information.

This is not meant to imply that any pre-diagnostic source will provide data appropriate for a syndromic surveillance program. Careful consideration must be given to the accuracy and timeliness of data. Specificity and sensitivity (that is, the percentage of false positives and negatives, respectively) have been a major concern of these types of surveillance systems (2,3). This is due in part to the lack of traditional case definitions. By design, these systems capture more "cases" than traditional surveillance systems and so are less specific. This is because clinically identified cases are based on a constellation of signs, symptoms and test results and, in contrast, syndromic surveillance methodologies use a much more restricted set of data elements.

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Sensitivity of Syndrome Detection

The level of sensitivity is achieved by establishing an upper variation limit (i.e., a threshold) that, when reached or exceeded, warrants an alarm or alert. Adjusting these threshold values becomes more of an art than science in many instances. The goal is to find a "critical" (i.e., specific) value where events are detected without an inordinate amount of time invested in investigating false alarms.

The intent of syndromic surveillance systems is to decrease the time between infection and detection (2). If data are not able to be collected in a timely manner (preferably real-time or near real-time), this objective cannot be met. Also, consideration must be given as to whether these data are truly representative of the total population.

In Ohio, the Ohio Department of Health (ODH) is monitoring several syndromic surveillance systems described below that utilize data sources meeting the above criteria.

Real-time Outbreak and Disease Surveillance (RODS) system

This system was developed by a team headed by Michael Wagner, M.D., Ph.D., from the University of Pittsburgh. It works by receiving an electronic message, via a secure Web interface, with certain data fields from hospital registration databases. No personal identifiers are used with the exception of patients' ZIP codes of residence (required for geospatial analysis). The data are analyzed and reported in aggregate format to eliminate any source identification.

Collected data fields include the chief complaint of the person seeking care. Chief complaints are classified into syndromes by RODS. The syndromes are then measured against a moving average of visits that is calculated at the ZIP code level. This system is accessed by users via a secure Web site and offers epidemiological plots, mapping of case counts and review of chief complaints. The system runs unobtrusively during routine emergency department activities and requires no additional work on the part of hospital staff. The development of an automated alerting function (i.e., pager, e-mail, etc.) is expected before the end of 2005.

As of Nov. 1, 2004, there were 44 hospitals actively submitting automated data; another 28 were in some stage of installation. ODH's goal is to have 117 hospitals participating by the end of summer 2005. Access to this system is open to select personnel at all local health departments and participating hospitals within Ohio.

National Retail Drug Monitoring (NRDM) system

Accessed through the RODS Web portal, this system is more commonly referred to as the "over-the-counter" system. This system collects electronic sales data from participating retailers for over-the-counter medications. The medications are separated by RODS into 18 categories based upon common use (e.g., cough and cold, antidiarrheal, fever, etc.). Data are analyzed to interpret volumes of sales within ZIP codes. More than 70 percent of Ohio's market share (i.e., available consumer population) is covered by this system. All local health department personnel are authorized access to this system.

BioSense

Much like RODS, visits to Veterans' Administration (VA) clinics and Department of Defense (DoD) facilities are monitored by the BioSense project. Coordinated through the CDC, this system provides ZIP code-level data for urgent care and emergency visits to the 18 VA facilities and the one DoD hospital in Ohio. Access is gained by the user through a secure Web site. Data analysis is provided to detect higher-than-expected visits utilizing two statistical models. Analysis can also be viewed using a mapping function and chief complaints can also be reviewed. As with RODS, data can be downloaded for further analysis by the user.

In addition, the BioSense project reports the number of diagnostic lab tests that are ordered by physicians through LabCorp (an independent medical laboratory). In addition to these established systems, ODH is in the process of developing others as described below.

Enhanced Animal Disease Surveillance

ODH is also working on an interagency project to develop an animal disease reporting and surveillance system. In cooperation with the Ohio Department of Agriculture, United States Department of Agriculture and the Ohio Veterinary Medical Association, ODH is developing a system that would permit veterinary practitioners to report the incidence of disease in animals. This system will permit analysis of data to detect any animal disease clusters that may be occurring before, during or after human outbreaks from the same agent.

Health Information Hotline Surveillance

Another initiative involves collecting data from health information call centers, partitioning the data into syndromes and analyzing it for aberrant clusters and other trends. The Ohio project will supplement a similar national-level project undertaken by Harvard Medical School and Harvard Pilgrim Health Care.

Other Applications and the Importance of Complementary Systems

These systems are being evaluated to assess their effectiveness in detecting outbreaks both separately and together using historic outbreaks in retrospective analyses. Although promoted as early outbreak detection systems, syndromic surveillance can be applied to other purposes (4). These include: (a) finding aberrant patterns in the context of a widespread exposure; (b) tracking a proxy syndrome during a known outbreak; (c) providing reassurance that evidence of biological terrorism has not been found.

One may be tempted to ask, "Why so many systems? Isn't one enough?" As was mentioned earlier, syndromic surveillance systems inherently rank rather low in specificity. By their very nature they detect many things that may manifest within the population under surveillance. One important way to increase the specificity is to have many systems in place to compare against each other and to provide redundancy (2). Thus, each system comprises a single tool of the larger toolkit of surveillance.

Signal Validation and Response

A question that needs to be addressed is, "What do we do if we detect something?" Many of the statistical models used in these systems are novel and yet to be proven in real-world events (5). Therefore, a certain amount of caution is warranted before "rallying the troops" over an alert from one of these systems. However, the detected anomalies or signals cannot be ignored and warrant attention.

When multiple systems are in place, the process of signal validation begins when the first alert is detected. Are any of the other syndromic surveillance systems alerting as well? If they are, this is an indicator that the event may be real and not the result of inherently high sensitivity or data error. If not, then a closer look at the data is in order. Items to consider are duplicate cases, a recent "dump" of data (as may be seen in a call center catching up on files) or chief complaints within the cluster which are obviously not related.

In addition, other properties will also dictate actions needing to be taken. When the alert is the result of only a few additional cases, perhaps waiting for confirmatory laboratory analysis is prudent. However, if the alert is the result of a large influx of patients and this increase is sustained over time, perhaps a more aggressive approach is warranted. This could include initiation of active surveillance (effectively going out and getting information), coordination with external response partners and case interviews. The level of response should be specified in a procedural document that weighs the aggressiveness of response against the magnitude and persistence of the alert.

Syndromic surveillance has its share of skeptics and an equal number of defenders. Many argue that there is no evidence that this type of surveillance will work or will work any better than traditional surveillance. The required type of evidence will not come without the occurrence of a substantial outbreak. However, in the interim, there are mounting

Syndromic Surveillance—continued

indications that syndromic surveillance does work. Each month more and more case studies are published that provide support for this new and evolving surveillance methodology.

The skeptic may remember a novel approach to cholera prevention in 1849 London. Dr. John Snow utilized mapping skills to locate cholera patients in relation to their water supply. The outbreak was brought to an end after the handle to the pump of the contaminated well was removed. Time will determine whether syndromic surveillance is the pump handle of public health for this generation.

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New Lab Techniques Streamline Tuberculosis Control in Ohio

by Frank Romano, B.A., Public Health Adviser, Ohio Department of Health Tuberculosis Prevention and Control Program, and Kevin Sohner, B.S., Microbiology Supervisor, Ohio Department of Health Laboratories

Two new laboratory testing techniques have been added to the Ohio Department of Health's (ODH) arsenal to combat tuberculosis (TB). Beginning in early 2005, ODH Laboratory will use the Amplified™ Mycobacterium Tuberculosis Direct (MTD) test for the laboratory diagnosis of TB. Also, in July 2004, the ODH TB Prevention and Control Program was approved to participate in the Centers for Disease Control and Prevention's (CDC) Universal Genotyping Program, which was launched by CDC in January 2004. The use of these testing techniques and participation in these programs will greatly enhance ODH's TB control and prevention capabilities and ensure that the most modern methods are used to mitigate and control TB in Ohio.

Since 1991, the United States has experienced a steady decline in TB due to significant public health efforts. However, TB is still a major public health problem in this country. Because TB can become drug resistant, it is important for the health care community to make the correct diagnosis quickly.

Mycobacterium Tuberculosis Direct (MTD) Test

The MTD test detects *Mycobacterium tuberculosis* rRNA directly and rapidly while delivering the sensitivity of standard media culture. The test is specific for *Mycobacterium tuberculosis complex*. MTD is the first Food and Drug Administration (FDA)-approved direct test for the diagnosis of smear-positive and negative specimens. Recent CDC guidelines highlight the role of the MTD test in the diagnosis of patients

suspected of having TB (1).

The MTD test is used with specimens from patients showing signs and symptoms consistent with active pulmonary tuberculosis. The test is used in addition to acid fast bacillus (AFB) smear and culture. It is still important to perform culture for confirmatory results and for drug susceptibility information on isolates of *Mycobacterium tuberculosis*.

There are two major advantages associated with the use of MTD testing. First, MTD helps the laboratory improve workflow by utilizing a single tube process. More importantly, it increases efficiency by providing results in 2.5 to 3.5 hours (instead of days or weeks), and offers diagnostic labs and TB control programs one more effective tool in the fight against TB.

The MTD test helps institutions utilize resources more efficiently. Specifically, the test helps make the correct diagnosis swiftly and accurately, which is critical in the management of TB. Patients with *Mycobacterium tuberculosis* are quickly identified and the necessary treatment regimen can be initiated promptly.

By making the diagnosis quickly, the health care system is able to save the costs associated with inappropriate treatment and avoid the unnecessary isolation of patients with "mycobacterium other than tuberculosis." The estimated costs associated with an inaccurate diagnosis of TB have been shown to be quite significant. For example, "[the] unnecessary institutional isolation [of a patient] due to an inaccurate positive diagnosis has been documented to have costs of $11,576" (2). Other advantages for laboratories using MTD include reduced operating costs and decreased cross contamination.

Universal Genotyping Program

On Jan. 15, 2004, CDC began the Tuberculosis Genotyping Program to provide genotyping services to participating TB programs in the United States. CDC has contracted with two genotyping laboratories, one in Michigan and one in California, to provide these services. Participating TB programs may submit one culture-positive isolate from each TB patient within their jurisdiction to a designated laboratory. In certain circumstances, TB programs may submit additional isolates from the same patient. The genotyping laboratories analyze isolates from current patients, but TB programs may also request permission to submit selected isolates collected in the past.

The implementation of universal genotyping (i.e., submitting one culture-positive isolate from every patient with TB) has substantial benefits. The research findings of the National Tuberculosis Genotyping and Surveillance Network and the application of genotyping by TB programs demonstrate that, through genotyping:

- Contact investigations will be enhanced, expedited and prioritized;
- Unsuspected relationships between cases and new and unusual transmission settings will be discovered;
- Outbreaks will be detected earlier and controlled more rapidly;
- Transmission that occurs between patients who reside in different jurisdictions will be detected more readily;
- False-positive cultures will be identified more easily;
- TB programs will be able to assess distribution and prevalence of *M. tuberculosis* strains; and
- TB programs will be able to evaluate the completeness of their contact investigations and progress toward TB elimination by monitoring genetic clustering as a surrogate marker of recent TB transmission.

Genotyping services are provided at no cost to participating TB programs; ODH covers the packaging and shipping costs. Ohio shipped its first batch of TB isolates to the genotyping laboratory in Michigan on Oct. 27, 2004.

With the implementation of these state-of-the-art, powerful tools, ODH renews its commitment to maintain and apply the most modern and advanced TB prevention and control practices available.

New Lab Techniques Streamline Tuberculosis Control in Ohio—continued

and other 21st century techniques will ensure ODH remains on the cutting edge of technology and efficiency as Ohio moves toward TB elimination.

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Testing for Pertussis: The Laboratory's Role

by Marian Rodgers, R.N., M.S.N., M.P.H., Infectious Disease Control Consultant, Mary DiOrio, M.D., M.P.H., Medical Epidemiologist and William Becker, D.O., M.P.H., Medical Director, Ohio Department of Health Laboratory

The news media reported a surge in pertussis (whooping cough) cases in 2004. Every week seemed to show another state reporting an outbreak of *B. pertussis* infections. Ohio media reported their fair share of such stories, because the 764 Ohio case count reported in 2004 was more than double that of 2003 (328).

With a nationwide rise in reported cases, public health and patient care providers are asking, "What was different in 2004?" Is the increase in pertussis part of a natural cycle? Although pertussis is an endemic disease with three to five year cycles of increased case counts, last year's numbers far exceeded the previous peak of 523, recorded in 1993.

Is the increase due to waning immunity? Immunity from pertussis vaccination likely lasts five to 10 years. Thus, adolescents and adults with waning immunity are important in the persistence of new pertussis infections and these individuals often serve as the source of exposure for infants and young children. Is the increase due to better awareness about pertussis and increased testing for cases? Health care providers are ordering more pertussis tests as they increasingly recognize the mild or atypical disease that occurs in older children and adults. In addition, improved testing methods have aided diagnosis, which has led to the recognition of more cases.

Nevertheless, pertussis can still be difficult to diagnose and choosing the right test is crucial. There is no "rapid" test for pertussis. The diagnosis of pertussis should always start with an appropriate history and clinical examination by a health care provider.

Clinically, pertussis usually begins with mild upper respiratory symptoms (the catarrhal stage): runny nose, mild cough and perhaps a low-grade fever. After one to two weeks, the cough worsens as the patient enters the paroxysmal stage. In the typical case, the patient coughs in short, severe spasms, each cough followed by a gasping, strained inhalation. In young children, this produces the classical inspiratory whoop. The cough of pertussis can be severe, can result in the production of thick respiratory secretions and sometimes can induce vomiting (post-tussive emesis). Fever remains low grade, if present at all. It is noteworthy that children under 6 months of age may present with apnea. Children are

also at risk of developing pneumonia (22 percent) and seizures (2 percent). Older children and adults may have milder, atypical disease. However, the cough may last for weeks to months, slowly improving over time.

Diagnosis of Pertussis

Several types of laboratory tests are available to help establish the diagnosis: culture, direct fluorescent antibody (DFA) testing, serologic testing and polymerase chain reaction (PCR) testing.

Culture Testing:

Culture is still considered the gold standard for the diagnosis of pertussis by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). The specificity of culture is 100 percent; moreover, it provides isolates for genotypic analysis and antibiotic susceptibility testing in cases where these additional studies might be necessary.

However, it should be remembered that *B. pertussis* is a fastidious organism. Cultures require special media and may take five to 12 days to grow, if they grow at all. The sensitivity of cultures for *B. pertussis* varies in the literature from 10-54 percent and this fact is often cited as a disadvantage of the test. This low observed range of culture sensitivity could be caused by any one or more factors: (a) previous pertussis immunization; (b) prior antibiotic use; (c) specimen collection late in the course of illness; and (d) poor quality of specimen. Quantitative studies have found fewer organisms in the throats of those infected after vaccination. Cultures seldom grow if any antibiotic was taken by the patient before the specimen was obtained. The lower number of organisms present after two to three weeks of illness makes obtaining a positive culture difficult after that time has elapsed. A good quality specimen requires a vigorous nasopharyngeal swab (i.e., not a throat culture). The advantage of cultures is that a positive one confirms the clinical diagnosis. It is also available at most clinical laboratories and, with the exception of DFA testing, culture is probably the least expensive testing option.

Direct Fluorescent Antibody (DFA) Testing:

DFA testing is a rapid way to directly detect *B. pertussis*. Is DFA testing an acceptable alternative or supplement to culture? The sensitivity of DFA is somewhat better than that of culture. A study comparing different methods of diagnosis found DFA to have sensitivity of 52.2 percent. The 2003 Report of the Committee on Infectious Disease of the American Academy of Pediatrics (*Red Book*) notes "the test has variable sensitivity and low specificity, requires experienced personnel for interpretation, and is not a reliable criterion for laboratory confirmation of the diagnosis."(1) However, the test requires less time and results are usually available within 24 hours after the test arrives in the laboratory. A DFA test may have a false-negative result for many of the same reasons as a pertussis culture: (a) poor quality specimen; (b) testing late in the course of the illness; or (c) testing obtained after the individual has taken antibiotics.

As opposed to culture, a DFA test can not be used as a confirmatory test for pertussis because of the test's low specificity: that is false-positive results may occur. Because of the need for special equipment (e.g., fluorescent microscope) and experienced staff, the test is available only at a few clinical laboratories. This means a sample may require transportation to a regional or reference lab. Because of issues with specificity, the test results are not considered adequate to confirm a case for public health surveillance.

Serologic Testing:

Serologic tests for the diagnosis of pertussis are not widely used in this country.

Should serologic testing be recommended for routine use by public health and private health care physicians? Probably not. Serologic testing may occasionally be useful for evaluating patients who have been coughing several weeks with a possible "post-pertussis" cough, but interpretation of the many available tests can be problematic. It is important to look at immunoglobulins G, M and A (IgG, IgM, IgA). IgG elevation in a single specimen may reflect vaccination-induced antibody. IgM elevation may reflect recent infection, although its elevation alone is difficult to evaluate. IgA elevation is felt to be a sensitive indicator of disease, but it may not be pre-

sent during the early stages of infection. Paired serologic testing is generally recommended, but patients are often reluctant to return for convalescent testing once their illness is over. Interpretation can be made only using the processing laboratory's reference ranges and in the context of the patient's symptoms.

If serologic test results are not considered suitable confirmatory evidence, then what role (if any) do they play in public health surveillance? Why record them in pertussis reports? A serologic test result with a positive IgM or IgA may be worth investigating. Investigation may find more evidence to suggest that the individual has an epidemiological link to a confirmed case. Usually an outbreak discovery happens with receipt of confirmatory test results, but there may be a time when an outbreak is first discovered by further investigation after receipt of a cluster of positive serology test results.

Polymerase Chain Reaction (PCR) Testing:

PCR testing is quickly becoming the diagnostic tool of choice for pertussis. Studies show a sensitivity of 93-100 percent and a specificity of 97 percent. PCR works well both early in the course of disease and even later when organisms are no longer viable in culture. A special advantage to PCR is the short time required to obtain clinically useful results. Most laboratories offer results within 24-48 hours, with the actual testing process requiring only a few hours.

PCR testing is subject to the same interferences and sample problems as culture, but most authorities feel that PCR testing is much less affected by these factors than culture. Both false-positive and false-negative results are possible with PCR testing, but fortunately these are relatively rare in good laboratories. PCR is still more expensive than culture and offered by few hospitals due to the requirements for rigorous validation and staff training.

In Ohio, if PCR test results are positive on a properly submitted sample, there is no reason to perform a culture for either clinical purposes or public health surveillance confirmation. The Ohio Department of Health accepts a positive PCR test result as confirmation of a case of pertussis if the source patient has clinical symptoms of pertussis. If the test is negative the care provider might find a culture helpful if still considering pertussis as a diagnosis based on clinical history and physical examination.

Lastly, interpretation of any of the tests becomes impossible if the person being tested does not exhibit clinical symptoms. Studies in which asymptomatic children were cultured after exposure to other children with confirmed symptomatic infection have demonstrated that *B. pertussis* can be recovered from their throats. Asymptomatic individuals do not meet the case definition for public health surveillance and have not been shown to transmit illness. Proper testing can be critical for establishing the diagnosis but must be interpreted in light of the clinical evaluation.

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Spiders: Friends or Foes by Robert A. Restifo, M.S., Chief, Vector-borne Disease Program

For more than 30 years, entomologists with the Vector-borne Disease Program (VBDP), Ohio Department of Health have been dealing with calls about spiders and spider bites. The majority of calls were concerned with only two groups of spiders: brown recluse and black widow spiders.

Until about 10 years ago, the most current information about species in Ohio was compiled in the 1920s. In 1995, Dr. Richard Bradley, an associate professor at The Ohio State University, Marion branch, began a survey of spiders in Ohio to update the list and improve the understanding of spiders and their ecological importance. According to Bradley, there are almost 600 species of spiders found in Ohio. For a current list of species found in Ohio, information on field ecology and more links, see his Web site at: http://www.marion.ohio-state.edu/spiderweb.

Because of the general lack of knowledge and understanding about spiders and their biology as well as misleading folklore, most people think of all spiders as huge, ugly, hairy threats to their children and their health. Nothing can be further from the truth. Spiders are very shy creatures, more likely to run away than attack an animal as large as a human, and this is true of even the three poisonous spiders in Ohio (see below).

The Diversity of Spiders

Species vary greatly in size, appearance, habits and behavior. Most spiders have bodies that range in size from one to 10 millimeters, but some have bodies almost two inches long and leg spans of six to eight inches. The variation in body shape and coloration is astounding. Some are long and narrow, almost stick-like. Others look like ants. They can be short and flat or very round. Some are very hairy. Most spiders are various shades of brown to black (good for hiding on the ground, logs or bark). However, some are very brightly colored with reds, yellows, greens or blues. Spiders can be found almost everywhere from the arctic to the equator, from below ground level to tree tops.

Spiders use numerous tactics to capture food. Most spiders spin a web in which they catch their prey. Certain spiders will "swim" on water and even dive with an air bubble wrapped around them. Some, trap door spiders, make burrows in the ground from which they spring to catch their prey. Another tactic used by some spiders is to wait suspended in their webs for an unsuspecting insect to fly in and get trapped. Some literally stalk their prey, running it down and jumping on it.

Spiders are predators, usually feeding on insects and other small animals. Thus, they are considered to be "good guys," beneficial because they eat pest or nuisance insects. Some of the large, so-called fishing spiders will occasionally catch small fish. Other large species may catch small birds, snakes or frogs. They all feed on the body fluids of their prey. Spiders do not have teeth and cannot chew. However, they have two "fangs" with which they inject poison, digestive enzymes and suck up the body fluids of their prey. Small spiders merely suck out the body juices, leaving the insect exoskeleton intact while larger spiders may indeed consume most of their prey, leaving only a small pile of indigestible material.

Webs

Spiders are probably best known for their ability to produce silk. This is an amazing compound, with numerous uses. Many species use silk to form webs of various shapes. The orb weavers form large, flat circular webs. Funnel-web weavers spin their webs in vegetation, usually grass; these are sheet webs with a funnel in which the spider hides. Cobweb weavers spin their webs in corners. Some webs are so disorganized that they are not recognized as a web. Some spin silk into a sticky ball on the end of a non-sticky thread and dangle it. Flying insects will land on the ball, get stuck and be eaten. A few spiders spin a small square web, hold it by their legs and trap prey by pressing the web onto the prey.

Spiders that wander or jump from place to place will spin silk as a drag line, bridge line or anchor line, securing them to the substrate. Small spiders and spiderlings (immature spiders) will spin silk threads that can carry them from place to place by air currents. This is called "ballooning" and is a method of long-distance travel. Tunneling

and trap door spiders use silk to line their lairs and hold the trap door on the tunnels. Eggs are wrapped in silk to protect them and the spiderlings they hold. Many spiders wrap their prey with silk to protect it until they are ready to eat it. Some male spiders, notably black widow males, gently subdue females by wrapping them in a silk "veil" during their courtship rituals.

Ever wonder why spiders do not get caught in their own webs? Webs have sticky threads and non-sticky threads. The spider knows which is which and will walk only on the non-sticky threads.

Silk has been used by humans to make cloth, medicines and even to promote blood clotting by covering wounds with webs.

Spider Bites

It is the ability of spiders to inject venom that causes all the fear and panic. Folklore about the threats of black widows and movies such as "Arachnophobia" perpetuate the erroneous information and unfounded fear of spiders. The venom of the vast majority of spiders is a neurotoxin, used to kill or paralyze prey until they are consumed. The venom of the brown or violin spiders actually necrotizes skin tissue. But the venom of 99 percent of the spiders is harmless to humans or causes a large, mosquito bite-like itchy swelling that lasts a few minutes to a few days. How many times have tarantulas been used in movies, from Indiana Jones to James Bond? Do you really think that Sean Connery or Harrison Ford would allow a deadly spider to crawl around on him? These very large, hairy spiders are in reality very docile and not prone to bite.

The severity of the reaction to a spider bite is dependant on the amount of venom injected (which is controlled by the spider, its age, physiological status and excitement level) and the physiological response of the person bitten. The vast majority of bites result in either no symptoms or a reaction no more serious than a wasp sting. In the very rare instance when there is a severe reaction, symptoms may range from a painful, rigid, red area around the bite to shooting pain and red streaks to systemic symptoms which include profuse perspiration, nausea, vomiting, fever, chills, faintness, tremors, loss of muscle tone and general motor paralysis that could lead to difficulty breathing. As Dr. Willis Gertsch, a world famous spider expert, wrote, "Only in a small percentage of cases is the offending spider or arthropod apprehended as evidence. Great care must be exercised by the doctor in evaluation of the symptoms without the presence of the biter." In other words, without having the spider that actually bit the patient, the person evaluating the bite is only guessing about the cause of the symptoms.

Poisonous Spiders

There are very few poisonous spiders; only a handful of species out of the hundreds that occur in the United States are considered by experts to be poisonous. There are three poisonous spiders that can be found occurring naturally in Ohio: black widows, brown recluse spiders and the common yellow sac spider.

The most well known poisonous spiders are black widows. This is somewhat of a misnomer as many species are very brightly colored with red and yellow. There are upward of 30 species of widow spiders worldwide, five known from the United States and only two naturally occurring in Ohio. They are in the family Theridiidae, the cobweb weavers or comb-footed spiders. Widow spiders are in the genus *Latrodectus*. Ohio species are quite attractive, being fairly large (12-16 mm long), shiny black spiders with long black legs and a globose abdomen with a red hourglass mark on the underside of the abdomen.

Black Widow Spider

There may be other red spots, depending on the species and age of the spider. They are not hairy and spin webs in undisturbed areas like outbuildings, wood piles, trash dumps, outhouses, etc. They are very shy and docile and will attack only when disturbed. Their venom is neurotoxic. Ohio species are

the Northern Black Widow, *Latrodectus various* and the Southern Black Widow, *L. mactans*. In the past several years, VBDP entomologists have identified the Western Black Widow, *L. hesperus*. These have been found in shipments of grapes from the Southwest and discovered at the distribution centers for the grocery stores.

Brown Recluse Spiders

The spiders that get the most coverage in the media are the brown spiders, including the infamous brown recluse spider. There are more than 50 species of this tropical group worldwide, 13 or so in the United States, but only two have been found in Ohio: the brown recluse spider, *Loxosceles reclusa,* and the "non-recluse" brown spider, *L. refescens*.

Brown Recluse Spider

They are very rare in the state and usually found in areas that are undisturbed for long periods of time (months to years). The normal range of the brown recluse is the southcentral United States, from Texas to western Georgia and the Florida panhandle north to southwest Indiana and west to Nebraska. They have been found as far north as southern Canada, but always in buildings. In the author's 30 years of experience in Ohio, brown recluse spiders have been identified from storage rooms being converted into offices, the attics of old houses and a sub-basement storage room. In one instance, a family with two young children found almost 40 brown recluse spiders in the home over a three-year period in the living spaces. No one was ever bitten. Upon investigation by a VBDP entomologist, spiders were found to be occupying the wall voids which were not insulated. Once the pest control operator got his pesticide application into the voids, no more spiders were found. This attests to just how shy and non-aggressive the spiders are. Many species have a dark brown violin shaped mark on the cephalothrax (combines head and thorax), thus the common name "violin or fiddleback spiders." These spiders are brownish in color and nine-12 mm long. They have six eyes rather than the normal eight. All the recluse spiders produce venom that can cause necrotic skin lesions that may take months to heal entirely. In very rare cases, hemolytic anemia can occur. Other species in this genus found in tropical areas can produce venom that is much more potent and can cause more serious symptoms.

Common Yellow Sac Spiders

The third "poisonous" spider (*Chieiracanthium mildei*) is a very common spider in Ohio. This and a sibling species (*C. inclusum*) are the only two species so far found in the state. Common yellow sac spiders are the small yellowish spiders people commonly see in the corners of the ceiling and walls and outdoors in vegetation. There have been reports of these spiders causing necrotic skin lesions similar to those caused by the brown recluse. Thus, these may be the spiders actually responsible for most of the "brown recluse" bites in areas where brown recluse spiders are not known to occur. However, for as common as the sac spiders are, the number of reported bites is very small, indicating that either the number of bites is small or that the venom does not cause serious symptoms in most people.

Hobo Spiders

There is a spider in the northwest United States that is documented to cause necrotic skin lesions called the hobo spider, family Agelenidae, *Tegenaria aggrestis*. This species does not occur in Ohio, although a sibling species does. This is a common funnel-web weaver, forming sheet webs in vegetation; the web has a funnel at one edge in which the spider hides. When the information about the hobo spider was first published in the popular media, people across the country erroneously reported seeing it, being bitten by it and having it living in their homes.

Spider Hoaxes

This leads to the topic of spider hoaxes, of which there is a

Spiders:Friends or Foes—continued

plethora of stories from the exaggerated to the ridiculous. People should be very careful about they read in the popular press. A good source of information about spider hoaxes is a Web site maintained by the Department of Entomology at the University of California at Riverside. It can be accessed at: http://spiders.ucr.edu/

Treatment

The treatment of spider bites is a controversial topic, with many opinions being expressed, but little hard science to back up claims of successful treatment. An antivenom for black widow spider bites exists. A commercial antivenom for brown recluse spiders exists, but it is not available in the United States (1). Several drugs have been used to treat bites, including steroids, hydroxyzine hydrochloride and dapsone, but with varying degrees of success. These bites can become infected with bacteria unrelated to the spider. The initial care of spider bites should include, as a minimum, routine first aid: elevation and immobilization of the affected limb, application of ice, local wound care and tetanus prophylaxis (1). Serious bites, or any bite by a known poisonous spider, should be evaluated by a physician.

Reference

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Perinatal Hepatitis B Prevention: Public Health Management

by Jeff Vasiloff, M.D., M.P.H., Chief, HIV and STD Prevention; Ann Richardson, R.N., Perinatal Hepatitis B Nurse, Perinatal Hepatitis B Prevention Program; Joe Bronowski, M.P.H., Public Health Adviser, Immunization Program; Mary DiOrio, M.D., M.P.H., Medical Epidemiologist, Immunization Program; and the Ohio Perinatal Hepatitis B Workgroup

I. Background About the Disease

Hepatitis B is an inflammatory liver disease caused by the hepatitis B virus (HBV). Infection with HBV can cause both acute and chronic hepatitis. The precise reasons why some develop acute hepatitis and some develop chronic hepatitis are unknown.

Acute hepatitis B is usually a self-limited process, although, in rare cases, fatal fulminant hepatitis can ensue. Chronic hepatitis B, which is the persistence of infection for six or more months, can result in the insidious development of cirrhosis, end-stage liver disease requiring liver transplantation and, in some cases, hepatocellular carcinoma. Hepatitis B infection can almost always be prevented by pre-exposure hepatitis B vaccination, which is the rationale for universal vaccination.

Another consequence of chronic or acute hepatitis B is the high likelihood of transmission of the virus from an HBsAg-positive pregnant female to her newborn at the time of delivery. Perinatally acquired hepatitis B usually results in asymptomatic or subclinical chronic hepatitis in the newborn. The infants who acquire hepatitis B at birth are at very high risk of the eventual development of the complications of chronic hepatitis B mentioned above. As many as 25 percent of perinatally infected infants will die as adults of chronic liver disease produced by chronic hepatitis B infection (1). Further, these chronically infected children remain infectious throughout their lives.

It is fortunate that perinatal hepatitis B can be prevented despite exposure of the newborn to maternal virus during delivery. In fact, the transmission of perinatal hepatitis B infection can be prevented in about 95 percent of infants born to HBsAg-positive mothers by early active and passive

immunoprophylaxis of the infant (2).

Post-exposure immunoprophylaxis using hepatitis B immune globulin (HBIG) administered at birth (i.e., within 12 hours of birth), in combination with the first dose hepatitis B vaccine given at the same time, followed by the remainder of the series of hepatitis B vaccine given over the next six months, is very effective in preventing neonatal infection.

As many as 1.25 million persons in the United States have chronic hepatitis B infection, and more than 20,000 infants are born to HBsAg-positive females per year (1). In Ohio, more than 300 infants are born each year to HBsAg-positive females (3). Further, the Centers for Disease Control and Prevention (CDC) have estimated that as many as 480 infants will be born to HBsAg-positive females in Ohio in 2005. Thus, it is paramount that these infants are protected from becoming infected.

II. The Ohio Department of Health's (ODH) Perinatal Hepatitis B Prevention Program (PHBPP): Past, Present, and Future

Since 1990, the ODH Perinatal Hepatitis B Prevention Program (PHBPP) has been conducting centralized case management of HBsAg-positive pregnant females and their newborns. In recent years, however, ODH has recognized the need to transition the primary responsibility for this important case management to the local health districts (LHDs). The primary reason for this is that case management is more effectively conducted at the local level for several reasons. LHDs: a) work in close proximity to cases; b) have the ability to make home visits; c) have knowledge of, and frequent contact with, local primary care physicians; and d) have familiarity with local referral services.

III. The New Model of Perinatal Hepatitis B Prevention Within Ohio

The new model will be one of local case management by the staff of the LHD in which an HBsAg-positive pregnant female resides. This means LHDs will assume primary responsibility for the prevention of perinatal hepatitis B within their jurisdictions. The ODH PHBPP will continue to provide guidance, technical assistance, trainings and other support throughout the transition and beyond. Thus, one way of conceptualizing the new model is one of shared case management between LHDs and the ODH PHBPP, yet a collaboration in which the primary responsibility for the prevention of perinatal hepatitis B resides with the LHD. It is noteworthy that a group of LHDs successfully began shared case management in 2004.

To further assist the LHDs, the ODH Immunization Program will continue to provide serologic screening, HBIG and hepatitis B vaccine to birthing centers and LHDs free of charge. Finally, the ODH Immunization Program, beginning in 2005, will provide funding to seven large city health districts to employ personnel to accomplish perinatal hepatitis B prevention at the local level.

IV. Transition Timeframe

In preparation for this transition, the ODH Perinatal Hepatitis B Workgroup was formed. This group consisted of nurses from LHDs that represented urban, suburban and rural areas of Ohio in addition to the ODH PHBPP nurse consultant. The recommendations of this group formed the basis of the new model of shared case management. The implementation of shared case management will take place in 2005 as LHDs receive detailed training manuals, face-to-face trainings conducted by the ODH PHBPP nurse consultant and software and training on ARTEMIS, a Web-based case management system.

V. New Model Goals and Objectives for LHDs in the Prevention of Perinatal Hepatitis B Within Ohio (Developed by the ODH Perinatal Hepatitis Workgroup)

A. Educate local physicians and health care agencies about the need to report HBsAg-positive females at every pregnancy regardless of prior reporting or immunization history.

1. Reinforce Ohio's disease reporting laws in regard to hepatitis B during each physician contact.
2. Provide educational materials as needed.

B. Ensure that the pregnancy status of all HBsAg-positive females is identified, entered into the Ohio Disease Reporting System (ODRS) and reported to the ODH PHBPP. The entry into ODRS and notification of the ODH PHBPP should be within five business days.

C. Educate local obstetricians, pediatricians and other health care providers on: a) the appropriate and timely administration of hepatitis B vaccine and HBIG; b) the necessity of obtaining post-vaccination serology among infants born to HBsAg-positive mothers and mothers of unknown hepatitis B status (including abandoned and safe haven babies); and c) the importance of pre-exposure universal immunization (i.e., birth dose given soon after birth and before hospital discharge and completion of the full series of vaccine). Provide updates as needed.

D. Ensure the completion of three doses of hepatitis B vaccine and post-vaccine serology among infants born to HBsAg-positive mothers and mothers of unknown hepatitis B status (including abandoned and safe haven babies). By the time the infant is 15 months of age, the LHD should make at least three contacts with the infant's parents, guardians or physician; contacts can be via phone, mail or in person.

E. Ensure that all HBsAg-positive infants are identified, entered into ODRS and reported to the ODH PHBPP. The entry into ODRS and notification to ODH PHBPP should be within five business days.

F. Promote and maintain collaboration among ODH PHBPP, LHDs and other partners.

VI. Fundamentals of Perinatal Hepatitis B Prevention

A. Serologic Screening of Pregnant Females

1. All pregnant females should be screened for hepatitis B infection (i.e., HBsAg) early in prenatal care.
   a. This screening should be done on all pregnant females during each pregnancy.
   b. Screening should be repeated later in the pregnancy in those females who are at high risk for the prenatal acquisition of hepatitis B.
   c. For common hepatitis B serological profiles, see Table 1.

B. Hepatitis B Vaccine and HBIG Usage in Term Infants Born to HBsAg-positive Mothers

1. At birth (within 12 hours of birth): Give first dose of vaccine plus HBIG.
2. At 1-2 months of age: Give second dose of vaccine.
3. At 6 months of age: Give third dose of vaccine.
4. For doses, see Table 2.
5. For immunoprophylaxis of preterm and low birth weight infants, see Table 3.

Table 1: Common Hepatitis B Serological Profiles

HBsAg	Anti-HBs	IgM anti-HBc	IgG anti-HBc	HBeAg	Interpretation
+	—	+		+	Acute hepatitis B
—	—	+	—	+ or —	Acute hepatitis B
+	—	—	+	—	Chronic hepatitis B, low viral replication
+	—	— (very, very rarely +)	+	+	Chronic hepatitis B, high viral replication
—	+	—	—	—	Vaccination-induced immunity
—	+	—	+	—	Natural recovery from hepatitis B infection (now immune)

Table 2: Recommended Dosages of Hepatitis B Vaccine (adapted from the *Red Book, Table 3.17, p. 325)**

Patients	Recombivax** Dose: µg (mL)	Engerix-B** Dose: µg (mL)
Infants of HBsAg-positive mothers (HBIG) [0.5 mL] is also recommended	5 (0.5)	10 (0.5)
Infants of HBsAg-negative mothers and children and adolescents younger than 20 years of age	5 (0.5)	10 (0.5)
Adults 20 years of age or older	10 (1.0)	20 (1.0)
Patients undergoing dialysis and other immunosuppressed adults	40 (1.0) special formulation for dialysis patients	40 (2.0) two 1.0 mL doses given in one site in a four-dose schedule

*American Academy of Pediatrics. Hepatitis B. In: Pickering LK, ed. *Red Book: 2003 Report of the Committee on Infectious Diseases*. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2003: 318-336.

** For other hepatitis B-containing vaccines, multiple antigen vaccines such as Pediarix and Comvax, which cannot be used for the birth dose, see *ODH's Immunization Manual*, currently being revised (February 2005).

Table 3: Hepatitis B Immunoprophylaxis for Preterm and Low Birth Weight Infants Born to HBsAg-positive or HBsAg-unknown mothers (including abandoned and safe haven babies [adapted from the *Red Book, Table 3.18, p. 328])**

Maternal Serostatus	Infant = or > 2,000g	Infant < 2,000g
HBsAg-positive	• Hepatitis B vaccine and HBIG (within 12 hours of birth) • Immunize with three vaccine doses at 0, 1 and 6 months of chronological age	Hepatitis B vaccine and HBIG (within 12 hours of birth) Immunize with four vaccine doses at 0, 1, 2-3 and 6-7 months of chronological age
HBsAg-unknown (including abandoned and safe haven babies)	• Test mother immediately for HBsAg • Hepatitis B vaccine (within 12 hours of birth) • HBIG within 12 hours of birth (preferred by ODH PHBPP and ODH Immunization Programs)** or await HBsAg result and if positive, give HBIG as soon as possible but in less than seven days (*Red Book* recommendation) • If HBsAg is positive, immunize with three vaccine doses at 0, 1 and 6 months of chronological age	• Test mother immediately for HBsAg • Hepatitis B vaccine (within 12 hours of birth) • HBIG within 12 hours of birth • If HBsAg is positive, immunize with four vaccine doses at 0, 1, 2-3 and 6-7 months of chronological age

***** American Academy of Pediatrics. Hepatitis B. In: Pickering LK, ed. *Red Book: 2003 Report of the Committee on Infectious Diseases*. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2003: 318-336.

** The rationale for giving HBIG within 12 hours (unless HBsAg is determined to be negative within 12 hours) is that the ODH PHBPP has seen cases where HBIG was held pending the HBsAg determination (which proved to be positive); the patient was discharged, lost to follow-up and, therefore, did not receive HBIG within seven days.

C. Hepatitis B Vaccine and HBIG Usage in Term Infants Born to Mothers of Unknown HBsAg Status (including abandoned and safe haven babies)

1. At birth (within 12 hours): Give first dose of vaccine. Draw maternal blood for HBsAg.
2. Give HBIG within 12 hours of birth (preferred by ODH PHBPP and ODH Immunization Programs) or await HBsAg result and if positive, give HBIG as soon as possible but in less than seven days (*Red Book* recommendation).

   Note: The rationale for giving HBIG within 12 hours (unless HBsAg is determined to be negative within 12 hours) is that the ODH PHBPP has seen cases in which HBIG was held pending the HBsAg determination (which proved to be positive); the patient was discharged, lost to follow-up and, therefore, did not receive HBIG within seven days.

3. At 1-2 months of age: Give second dose of vaccine.
4. At 6 months of age: Give third dose of vaccine (if mother is found to be positive). If found to be negative, give third dose of vaccine at 6-18 months of age.
5. For doses, see Table 2.
6. For preterm and low birth weight infants, see Table 3.

D. Post-vaccination Serological Testing Among Infants Born to HBsAg-positive Mothers (and Mothers Whose Serostatus Remains Unknown)

1. After the completion of the vaccine series, these infants should be tested for HBsAg (to determine whether immunoprophylaxis failed) and anti-HBs (to determine whether the immune response was sufficient to ensure continuing protection).
   a. This should be done after completion of the primary vaccine series at 9-15 months of age (three to nine months after the completion of the series, but never earlier than the ninth month).
   b. If quantitative post-vaccination anti-HBs is less than 10mIU/ml and HBsAg is negative, re-vaccination and follow-up serology should be repeated. See VI. E. 1.

E. Additional Vaccination

1. Additional vaccination is indicated in infants born to HBsAg-positive mothers who, after the completion of the primary series of vaccine, remain HBsAg-negative and demonstrate an insufficient immune response (as evidenced by an anti-HBs concentration of less than 10mIU/ml at 9-15 months of age).
2. The administration of additional vaccination can be approached in one of two ways.
   a. Additional vaccination method 1:
      i. Give three additional doses in a zero, one, and six month schedule followed by testing for anti-HBs one to three months after the last dose.
      ii. HBsAg should be drawn simultaneously with anti-HBs.
   b. Additional vaccination method 2:
      i. Give one additional dose (fourth dose) and test for anti-HBs one month later to see if a fifth dose is warranted.
      ii. If a fifth dose is warranted, re-test for anti-HBs after one month to see if a sixth dose is warranted.
      iii. If a sixth dose is warranted, re-test for anti-HBs after one month.
      iv. HBsAg should be drawn simultaneously with anti-HBs.
   c. After the completion of additional vaccination by either method 1 or 2, if the concentration of anti-HBs remains less than 10mIU/ml, no further vaccination is currently indicated.

F. Screening of Household and Sexual Contacts of Pregnant HBsAg-positive Females

1. Adult household and sexual contacts should be screened for hepatitis B and for immunity to hepatitis B (i.e., HBsAg and anti-HBs). Household contacts who are children or adolescents need not be screened except for those who are immigrants or international adoptees (4). For vaccination of contacts, see VI. G.

G. Hepatitis B Vaccine and HBIG Usage Among Household and Sexual Contacts of Pregnant HBsAg-positive Females

1. Susceptible household and sexual contacts of pregnant HBsAg-positive females should receive the full series of hepatitis B vaccine. This is all that is required if the HBsAg-positive mother has CHRONIC hepatitis B infection (unless there was an exposure to blood; see VI. H).

   a. If the mother has ACUTE hepatitis B, then the following should also receive HBIG:

      i) Infants less than 12 months.

      ii) Sexual contacts if sex was within the past 14 days.

   b. If a contact has been fully immunized or has received two doses of vaccine, HBIG need not be given.

   c. If a contact has received only one dose of vaccine, a second dose should be given if it is due, or, if it is not due, HBIG should be given.

H. Hepatitis B Vaccine and HBIG Usage Among Susceptible and Unknown-status Household Contacts of Pregnant HBsAg-positive Females in Which There Has Been an Exposure to Blood Regardless of Whether the Female Has Acute or Chronic Hepatitis

1. Give both HBIG and the full series of vaccine.

VII. Identification and Reporting of HBsAg-positive Pregnant Females: Local Health District Recommendations

A. All pregnant females should be screened for HBsAg during each pregnancy (See VI. A.).

B. All positive laboratory test results of Class A-2 reportable diseases, such as perinatal hepatitis B, are required to be reported to the LHD within the jurisdiction the pregnant female resides, per the Ohio Administrative Code. This means that any physician, health care agency or laboratory that detects a positive result for one or more hepatitis B serological markers (except anti-HBs) is required to report it to the appropriate LHD. [The presence of anti-HBs indicates either previous vaccination or resolved infection].

C. All females of childbearing age (i.e., 49 years of age and below) and both male and female children (age 15 and below) with one or more positive hepatitis B markers should be entered into ODRS (regardless of clinical status as acute or chronic hepatitis B).

1. The pregnancy status of all females of childbearing age should be entered into ODRS.

2. If the pregnancy status is unknown for a female of childbearing age who has one or more positive serological markers for hepatitis B (e.g., HBsAg, IgM anti-HBc, IgG anti-HBc, total anti-HBc, HBeAg, anti-HBeAg, hepatitis B virus DNA), the female's physician should be contacted to determine the pregnancy status. This should be entered into ODRS.

   a. If the physician does not know the pregnancy status, the female should be contacted directly.

   b. If the female has recently delivered, the LHD should collect clinical, diagnostic and serological marker data that allows a determination of the status of hepatitis B (e.g., acute, chronic, resolved). This should be entered into ODRS.

D. All pregnant HBsAg-positive cases (including repeat pregnancies) that are entered into ODRS should also be reported directly to the ODH PHBPP.

E. After the roll out of ARTEMIS software and training, case information should be entered into this perinatal hepatitis B Web-based, case management system. All open and closed cases should be reported to the ODH PHBPP.

VIII. Case Management of HBsAg-positive Pregnant Females: Local Health District Recommendations

A. The pregnant female should be interviewed by the LHD to identify all household and current sexual contact(s) within five business days. If the pregnant female has been followed by the ODH PHBPP during a previous pregnancy, she should be asked if there have been new household and/or sexual contact(s).

1. This information should be entered into ARTEMIS.
2. This information should also be directly reported to the ODH PHBPP.

IX. Management of Infants Born to HBsAg-positive Mothers or Mothers of Unknown Serostatus (including abandoned and safe haven babies)

A. Ensure/facilitate the receipt of the full series of hepatitis B vaccination and HBIG administration as needed (See VI. B. and VI. C.).

1. Birth information will be sent to the LHD from the ODH PHBPP.
2. If notification of delivery is not received within three weeks of estimated date of delivery, the LHD should contact the ODH PHBPP to check the newborn screening database for the date of birth. If no birth data are found, the LHD should contact the prenatal care provider to determine pregnancy/delivery status.

B. Ensure/facilitate the determination of post-vaccination serology (See VI. D.).

1. Upon completion of the full vaccine series, a post-vaccination serology letter should be mailed to the infant's medical provider as well as the mother.
2. In the letter to the mother, a congratulatory letter should be included.

C. Determine whether additional vaccination is needed (See VI. E.).

1. If post-vaccination serology results are not received from the medical provider, the LHD should contact the infant's medical provider for the results.
2. If post-vaccination serology results indicate hepatitis B infection in the infant, the LHD should:
   a. Contact the ODH PHBPP.
   b. Report the infected infant as a new case in ODRS per ODRS guidelines. The mother's ODRS case number should be indicated in the infant's record.
   c. Refer the infant for further medical follow-up.
3. If post-vaccination serology indicates that the infant has had an insufficient immune response, the LHD should ensure/facilitate additional vaccination (See VI. E.).

D. ARTEMIS should be used to record and track the entire management and follow-up of the infant.

X. Management of Household and Sexual Contacts

A. Serologic testing should be done on all household and sexual contacts to determine whether susceptibility to, immunity to or current infection with hepatitis B is present (See VI. F.).

1. The LHD should provide appropriate educational counseling to each household and sexual contact regarding the importance of screening and vaccination. ODH provides funding through the Immunization Program for hepatitis B testing and for the provision of hepatitis B vaccine.
2. The serologic testing information should be entered into ARTEMIS.
3. Any new cases of hepatitis B infection (including those in a pregnant female) need to be entered into ODRS as well as ARTEMIS.

B. Susceptible household and sexual contacts should be immunized (See VI.G. and Table 2).

1. If the pregnant HBsAg-positive female has CHRONIC hepatitis B, this is all that needs to be done.
2. If the pregnant HBsAg-positive female has ACUTE hepatitis B, HBIG should be given to infants less than 12 months and sexual contacts in which sex occurred within the past 14 days.
3. If a household contact or sexual partner received an exposure to blood from a pregnant HBsAg-positive female regardless of whether the female has ACUTE or CHRONIC hepatitis, HBIG should be given (See VI. H.).
4. This information should be entered into ARTEMIS.

XI. Case Closure

A. Upon both completion of the infant's three-dose series (or six doses if indicated) and documentation of seroconversion with post-vaccination serology (i.e., anti-HBs 10mU/ml or more), the infant section of ARTEMIS should be closed.

1. As noted above, if seroconversion does not occur after six doses, the infant section of ARTEMIS can still be closed because no further vaccination is recommended.
2. ODH PHBPP should be contacted on all case closures.
3. HBsAg should be drawn simultaneously with anti-HBs.

B. By the time the infant is 15 months of age, the LHD should make at least three contacts with the infant's parents, guardians or physician; contacts can be via phone, mail or in person. ODH PHBPP should be contacted on all case closures.

C. The household and sexual contact section can be closed if reasonable attempts have been made to complete this part of the investigation and case management. ODH PHBPP should be contacted on all case closures.

D. In the event that a pregnant HBsAg-positive pregnant female and/or an exposed infant transfers out of the jurisdiction, the LHD should contact the ODH PHBPP which will convey the information to the state health district within the state or U.S. territory of the female's and/or infant's new residence. The ODH PHBPP will update ARTEMIS.

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